EPA Region 10
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October 24, 2011

Nonene Spill at Loading Rack

Causal Learning Investigation

FINAL REVISION: January 16, 2012

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INCIDENT SUMMARY

On Oct 24, 2011 between 02:57 -04:40, approximately 50 bbl of nonene leaked to the ground from an oily water sewer (OWS) containment pan at the north nonene loading rack. Nonene originated from a bad order railcar that was being drained by an RP&S rail operator per instruction and oversight by his Shift Team Leader (STL). At that time, the operator and the supervisor believed that the railcar contained 50-100 gal of nonene. In addition, all visual indications were that the nonene was contained and conveyed to the OWS.

At 5:00 AM, shortly after draining was complete, reports of pervasive nonene odors prompted an investigation to locate the source. Approximately 11 hours later, PSR personnel discovered that the OWS drain hub inside the north nonene loading rack containment pan was actually plugged. PSR personnel then deduced that all or most of the nonene drained from the car had slipped over a low 3 inch section of containment and into the surrounding ballast rock. Nonene then travelled to the south where it was captured by a drainage ditch and routed into the clean water sewer system, leaving no visible evidence of a spill at the source.

The original estimate was reported to be 50-100 gal based on the short duration that the operator loaded the car. Estimates 2 days later based on tank volumes determined that the volume was actually 50 BBL.

This incident has been classified as a RAM Yellow (3D).

Date & Time the Incident Began:	October 24, 2011 02:36 AM
Investigation Start Date & Time:	October 28, 2011 07:00
Incident Investigators:	Sheri Baker and Mike Dubois
Facilitation:	Renee Majumdar
Management Sponsor(s):	Renee Porter

PROBLEM STATEMENT

Expected:	Nonene remains in primary or secondary containment
Actual:	Approximately 50 bbls of nonene flowed over the lip of the northern nonene rail car containment pan into the ballast rock during the draining of a bad order railcar.
Impact:	Environmental incident reportable to Dept of Ecology with potential for enforcement. Clean up of nonene from Effluent plant water. Longer term clean up of nonene from the soil. Nonene odors throughout plant via the clean water sewer

SITUATION DESCRIPTION

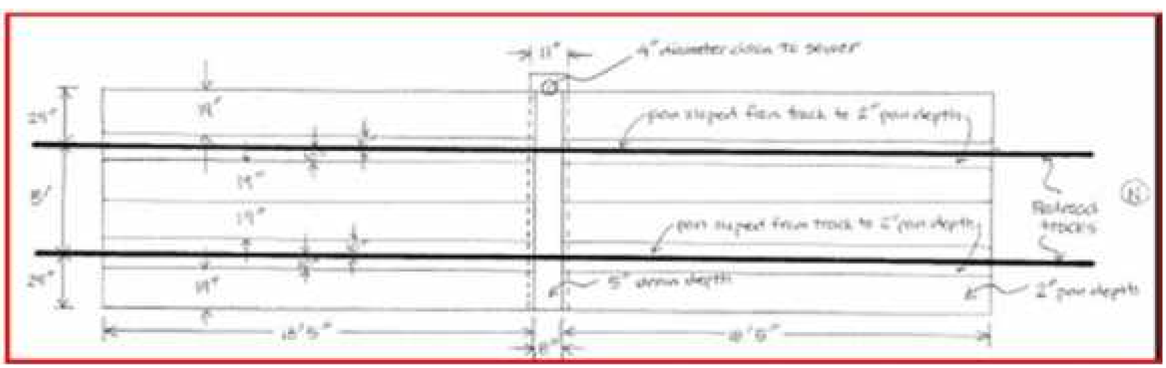
The nonene loading rack and containment system was built in 1991 and is located in the southwest area of the plant between 3rd and 4th street. The number of cars loaded per month varies with the market but rates have been steady in 2011 averaging from 25-35 cars per month. Loading of railcars is performed by RP&S operations according to procedure 23RACNO002 *Loading Nonene Tank Cars (Attachment 3)* which includes ensuring that certified railcar inspections are up to date and that each car passes a visual check before loading.

Part of the visual inspection includes determining if the car contains residual product (retain). If the car contains a small volume of retain, the procedure states that the operator is to drain the volume to the oily water sewer. Based on interviews with RP&S operators, the approximate accepted volume to drain to OWS versus recover to tankage is 30% or less full. Based on railcar gauging data, this volume could be anywhere from 1-10,000 gal.

Draining liquid material from a railcar involves opening the belly valve on the bottom of the car and allowing it to flow from the car into the containment pan below. The sloping of the containment pan is such that all liquid drains toward an 8 inch wide channel where it is then conveyed to a drain hub with a P-Trap routed to the Oily Water Sewer. Dimensions and characteristics of the containment pan including direction of flow are shown in Figure 1.

Figure 1: Shell PSR Nonene loading rack containment pan dimensions

Drip pan capacity*: 183.9 gal
Trench drain capacity: 29.1 gal
Total capacity: 213 gal
*Capacity as defined by total volume held under non-flow conditions



In the early morning hours of October 24, 2011, an RP&S operator began the process of loading nonene into two railcars (positioned North and South of each other). Before loading, the operator inspected each car using the *Shell Puget Sound Refinery Tank Car Inspection Form (Attachment 4)*. The North Car (SCMX4364) and the South Car (GATX 079701) both passed inspection.

The Operator then began the process of loading the north car per procedure. At 02:36 AM, he pressed the loading pump START button and positioned himself to look for leaks or abnormal situations on both the top and the bottom of the car. He immediately noticed that the bottom belly valve was leaking and pressed the pump STOP button within 5 seconds of starting the pump. The valve continued to leak into the containment pan at a rate of approximately 1-2 gal min. All the hydrocarbon appeared to be contained within the containment pan and flow to the oily water sewer.

In case the valve was simply not closed tightly, the operator made an attempt to close the valve more tightly. After his attempt, the leak continued. The operator then radioed the STL and requested he call him on the nearby ethanol rack phone. (Note: The purpose of the call would be to get further instruction on how to deal with the situation.) On his way to the rack to wait for the call from the STL, the operator turned on water from a hose and directed it into the pan to help flush nonene from the pan into the oily water sewer.

The operator then walked approximately 50 feet to the ethanol rack to wait for the phone call from the STL. While waiting, the operator mentally reviewed the steps he had taken to stop the loading and subsequent leak. He then remembered that he needed to close the ball valve on the upper deck of the loading rack to prevent gravity flow from the nonene tank (82) into the railcar. Since less than 10 minutes had passed, the operator believed that the volume loaded by gravity was insignificant. To be safe, the operator called the STL on the radio, asked him to meet him at the nonene rack, and returned to the rack himself to close the ball valve. The ball valve was closed at approximately 02:46.

The STL arrived at the nonene rack at approximately 02:50. He observed the nonene leaking into the containment pan and a stream of water from the hose flushing the nonene toward the drain hub. All liquid appeared to be completely contained in the pan and flowing down toward the drain hub. The STL then viewed the level through the gauge hatch on top of the railcar. The STL observed what appeared to be 1-2 inches of product in the bottom of the railcar. He asked the Operator how much he thought he had loaded. The operator responded that he wasn't sure but guessed the volume was approximately 50 gallons.

The STL and the operator discussed possible options such as trying to put the cap back on the bottom of the car, pressuring the car back to tankage, or draining the car to the OWS. They concluded that with the amount in the bottom of the car, the best option would be to drain the car to the OWS. They rationalized that this was the safest and fastest way to resolve the problem and no different than draining the retain that comes in many cars.

At 02:57 the rail rack operator further cracked open the rail car drain valve. The STL stayed to observe and assure no splashes were made outside of containment. Both the STL and Rail Rack Operator observed nonene completely within the containment pan. The STL was at the rack for approximately 20 minutes. The Rail rack operator remained within 50 feet of the containment pan. During the entire time the car was drainig from 02:27-04:40, nonene appeared to drain from the containment pan into the OWS hub on the west side of the rail rack.

Around 5:00 AM, the STL was informed of nonene odors near the Old Fire Hall and C Street. The STL believed these were likely caused by the rail car draining and went back to the rail rack to check on progress. At that time, the railcar was completely drained and there was a smell of nonene originating from the area. The STL assumed that the p-trap and sewer line needed to be flushed. He then turned on a stream of water to flush the containment pan.

At 6:00 AM, the STL began receiving additional calls of odors coming from the clean water sewer system from the lab area and HTU 3. Over the next hour, he and the Production Supervisor checked the clean water sewer system for odors, LEL, and secured bag samples of the vapors. Nonene odors were confirmed at the time. Fire water flushes were started into the clean water system from SRU4, D Street, and CRU 2.

Later that morning, the Production Supervisor and RP&S production specialist visited the nonene rack to help determine the cause of wide spread nonene odors. At that time, nonene was observed coming from the ground in the clean water storm ditch to the South of the nonene rack. Both believed that this was the cause of the odors and likely a result of a compromised oily water sewer line.

The RP&S OMS was notified immediately of the possible failed sewer. He secured sewer drawings and contacted Coastal, a contractor group, about using a camera to assess the condition of the sewer. Clean sewer flushing and monitoring by the STL continued throughout the day.

At approximately 4:00 PM, the Coastal Supervisor visited the nonene rack to assess the area for using a camera in the sewer system. A service water hose had been placed by the rail rack operator onto the Northern nonene car containment pan to help determine if the sewer line was possibly caved in. He observed the water cascading slowly over the lip of the sewer containment and flowing into the ballast rocks. He communicated his belief the sewer drain was plugged. Coastal proceeded to snake the sewer and found the P-trap had been plugged with fine scale and dirt.

The original estimate was reported to be 50-100 gal based on the short duration that the operator loaded the car. Estimates 2 days later based on tank volumes determined that the volume was actually 50 BBL.

Change in gross volume in tank 82 indicated approximately 50 bbls were loaded and drained from the rail car. However, the rail operator remembered the totalizer as reading 227 gallons when he reset it to start the next car. The WSTL was confident in the 1-2” product in the car.

In order to reconcile the difference in volumes, the timing of events was clarified with the rail rack operator around 5:30 PM on 10/25. Two tests were conducted to simulate 3 seconds of the pump running and tank gravity loading for 10 minutes into different rail cars. Both tests indicated the tank gauging estimate to be accurate. The final spill volume reported was therefore 50 bbl.

SEQUENCE OF EVENTS:

The following table outlines the sequence of events relevant to the understanding the mechanism of the spill and the duration and activities involved in determining the final spill volume.

Time	Event Description
10/24/11	
02:36	Operator began to load rail car.
02:36 + 5 seconds	Operator observed leaking belly drain valve and shut down load pump by pressing button at load rack.
02:37	Operator inspected belly drain valve to determine if it was tightly closed. He found that the valve was closed and still leaking.
02:38	Operator called WSTL on the radio and asked him to call him at the ethanol rack.
02:39	Operator started a stream of water via a hose to the containment pan. The purpose of the

	water was to flushing nonene from the leaking valve down drain hub and keep vapors down.
02:40	Operator walked to phone at the nearby ethanol rack. While waiting for phone call from WSTL, operator remembered that the car could continue to load by gravity if one of the valves on the loading arm is not closed. He had not closed the valve.
02:43	Operator walked back to nonene rail rack and communicated to WSTL via radio to meet at nonene rack instead of calling ethanol rack phone.
02:47	Operator arrived at the nonene rack and closed the ball valve on the loading arm located on the upper deck. (Note: railcar was loaded for approximately 10 minutes by gravity).
02:50	WSTL arrived at nonene rack. WSTL asked operator how much he thought he loaded. The operator responded "50-100 gal".
02:52	The WSTL visually inspected the railcar from the top and perceived that there was approximately 1"-2" of product in the car. The volume appeared to be approximately 50-100 gal as the operator had reported. Note: ACTUAL Depth was 11 inches or 8% of railcar.
02:55	WSTL and operator discussed possible options to empty car so it could be repaired (i.e. drain car or attempt to pressure off to tank). Based on volume observed in the car, the WSTL decided to follow normal operating procedure for handling small retain volumes. Normal procedure for small volumes of retain is to drain car to OWS.
02:57	Operator lightly cracked the valve open, releasing a garden hose size stream of nonene into the containment pan. WSTL observed to assure no splashes outside containment. STL observed water and nonene contained within the containment pan moving into conveyance channel filling it less than half full. All indications were that liquid was moving out of the channel and into the drain hub.
03:10	WSTL left the nonene rack.
02:57-04:40	Nonene continued to drain from the railcar with operator within 50 feet at all times. All nonene and water appeared to the operator to stay well within containment during this time.
03:12	Operator hooked up southern nonene rail car to begin loading
03:13	Operator observed that the total volume on the totalizer was 227 gals and deduced that a minimal volume was loaded by gravity and that the estimate he have to the STL for the north car was in the right range.
04:41	WSTL submits plant notice (R-501) for leaking valve that resulted in a release of nonene to containment. Volume reported = 50 gallons to containment. None was believed to be released to soil at this time.
04:51	Southern nonene rail car loading completed.
05:00	WSTL notified by plant personnel that nonene smell was observed approximately 1 block to the west of the nonene rack at the old fire hall.
05:05	WSTL revisits rack to check on draining. Draining of North rail car was complete at this time. WSTL flushed pan with additional water with the belief that the smell was from residual nonene in the containment pan or the P-trap in the drain hub.
05:25	WSTL makes relief with on-coming supervisor. Mentions report of odors in the plant.
06:00	WSTL receives call from employee near lab building reporting a clean water sewer hub w/odors. Additional call received from HTU3 operator of "hot" clean water sewer (high LEL)
06:00	At this time, WSTL were unsure of mechanism for contamination of clean water sewer. In case the OWS was somehow leaking in the CWS, WSTL requests NSTL to flush oily water sewer with water by adding firewater at Alky2. This would flush the majority of the sewer plant wide.
06:05	WSTL calls WS Production Supervisor for sewer hub investigation and picks him up at his office.
06:05 – 07:05	WSTL/Production Supervisor gather LEL readings and bag samples from the clean water sewer hubs.
07:05	WSTL then request operations to add water to SRU4, D St., and CRU 2 clean water sewer so

	that all hydrocarbon contamination could be collected at the clean water storm surge basin.
07:30 (approx)	Production supervisor and Production specialist visit nonene rack to determine source of odors. Looked for open bleeders – none observed. Believe possible oily water sewer line failure from lines draining railcar containment pan. Belief based on odors in area and nonene observed in ditch area to South.
09:00	Operator turns on water hose at North nonene rail spot to help with flushing and to give an idea of oily water sewer line integrity.
11:00	Supervisor received LEL readings report from HSE.
12:00-1:00	Supervisor rechecks LEL readings and observed 0 LEL at all hubs.
12:00 – 4:00	Production supervisor reviewing tank gauging data, rail car loading data to determine possible spill volume. Unable to explain difference in tank gauge data vs. operator reported volumes.
2:00	Flushing of clean water sewer shutdown based on LEL results.
3:00	HTU 3 operator reports reoccurrence of nonene odors. Supervisor restarted flush at 500 gpm from SRU4.
4:00	Maintenance contractor visits rail rack for job walk to determine sewer condition. Contractor and operator observed an almost undetectable stream of water from hose spilling over a 3 inch section of containment wall into ballast rock.
4:05	Operator moved water hose to Southern nonene rail spot to determine if same condition existed. Operator observed drain flowing and all material remaining within containment. Operator and contractor then determined that the North drain must be plugged.
4:15	Contractor snaked out sewer and found sewer plugged at P-trap with fine scale and dirt.
4:15	At this point, the mechanism for nonene contamination became clear to Westside Production Specialist and Westside Area Manager. Since drain was plugged, all the nonene from the railcar must have spilled over the 3 inch section of containment lip, into the ballast rock, then was partially captured in the clean water drainage ditch. From the drainage ditch, the nonene was then carried with water into the clean water sewer system. Since manholes on this sewer are not water sealed, vapors were allowed to travel upstream throughout the plant.
6:00 PM	Operator who drained the railcar was consulted to confirm volume drained from the railcar. He recalls vividly that the totalizer read 227 gallons before he started loading the south railcar.
6:00 PM	Began transferring water from clean water storm surge basin which had been contaminated with nonene to API via vacuum truck.
10/25/11	
11:00 – 4:30	Process Eng and Operations staff work to understand difference in the volume read by the totalizer and the lost volume indicated by tank 82 level data. The totalizer determined to be functional
5:45 PM	Operator who was on shift at time of draining consulted from home to better understand timeline and difference in volumes. Gave feedback on car being loaded by gravity approximately 10 minutes (which was not asked prior).
6:00 PM	Transfer of nonene contaminated water out of the effluent plant storm surge basin complete.
10/26/11	
10:45 – 10:55	In order to conclusively determine spill volume, a test was conducted at the nonene loading rack using 3 seconds run of pump and gravity loading for 10 minutes. Tank car was gauged out and totalizer meter readings recorded confirming approximately 50 bbls. Since these were the actual loading condition the morning of 10/24/11, 50 bbls was determined to be the volume of nonene spilled.

CAUSE ANALYSIS:

Refer to the attached Cause Tree (Attachment 1)

1.0 WHY DID ~1 - 50 BBL NONENE SPILLED TO GROUND FROM 2:57 TO 4:40 AM ON 10/24/11

1.1 Operator opened valve on bottom of car to drain to containment pan/OWS at 2:57 AM
AND
1.2 Railcar contained 50 BBL of Nonene.
AND
1.3 Operator and STL believed nonene was going to OWS the entire time the railcar was draining
AND
1.4 Nonene slipped over a 3 inch section of containment

1.1: WHY DID OPERATOR OPEN VALVE ON BOTTOM OF CAR TO DRAIN TO CONTAINMENT PAN/OWS AT 2:57 AM

1.1.1 Operator was told by STL to drain car to OWS.

1.1.1: WHY DID STL TELL OPERATOR TO DRAIN CAR TO OWS?

1.1.1.1 Rail car was bad order

- Bottom drain valve on the car was leaking

AND

1.1.1.2 The rail car needed to be emptied

- Rail car contained nonene
- AND
- Rail car needed to be emptied so it could be repaired

AND

1.1.1.3 STL thought the volume was comparable to typical retain volume

- Operator told STL the volume loaded was 50-100 gal
  - Operator initially determined volume based on the "few seconds" he had pumped into the car
- AND
- Operator continued to believe his estimate was within the right ballpark.
  - Operator read meter at "227" gal when he returned to load another car 1 hour later
- AND
- STL visually confirmed volume from top of car
  - STL believed a rough estimate was all that was required
  - AND
  - Visual assessment confirmed that operator reported volume was reasonable

AND
1.1.1.4 Draining retain volume in nonene cars to OWS is standard practice

- Draining to OWS is the fastest, safest, and most cost effective solution for small volumes
    - Pressuring back to Nonene tank runs risk of getting Nonene on tank roof (NWCAA reportable)
    - OR
    - Draining to OWS ensures product quality is protected
    - OR
    - Draining of retain to OWS is rare and represents a low annual volume. Rate of return for special piping to slop oil would likely be low

1.2: WHY DID RAILCAR CONTAIN 50 BBL OF NONENE?

1.2.1 1- 2 BBL was added by operator starting pump for about 5 seconds then stopping
AND
1.2.2 Additional 48 BBL was added via gravity

1.2.1: WHY WAS 1- 2 BBL ADDED BY OPERATOR STARTING PUMP FOR ABOUT 5 SECONDS THEN STOPPING?

1.2.1.1 Op Orders instructed to load that railcar (SCMX4364)
AND
1.2.1.2 Operator conducted and documented tank car inspection on SCMX4364
AND
2.2.1.3 Operator stopped pump after 5 sec.

- Belly valve was leaking
    - Valve closed but cause of leak unknown.

1.2.2: WHY WAS AN ADDITIONAL 48 BBL ADDED VIA GRAVITY

1.2.2.1 Ball valve on loading arm was left open for 10 min after pump was stopped

- Operator remembered 10 minutes after stopping pump that ball valve needed to be closed to stop gravity
    - Operator was relatively new on the job (14 months)
    - OR
    - Operator perceived that stopping pump was primary mechanism to stop flow. (i.e. gravity a minor contributor)

1.2.2.2 Head pressure at tank elevation was greater than head pressure at railcar elevation.

1.3: WHY DID OPERATOR AND STL BELIEVE NONENE WAS GOING TO OWS THE ENTIRE TIME THE RAILCAR WAS DRAINING?

1.3.1 Operator was within 20 feet of containment pan and monitoring containment the entire time rail car was draining
AND
1.3.2 Operator and STL assumed if nonene was contained in the pan, it would drain to the OWS
AND
1.3.3 nonene appeared to be contained in the pan

- The height of the liquid in the trench was one inch below the top of the lip; area of containment where nonene slipped by was only 3 inches wide.
-
  AND
- Main containment pan was free of liquid

AND
1.3.4 Drain pan was emptying toward OWS drain hub as expected
- Hub was lowest spot in the containment pan
  AND
- Containment wall where nonene leaked was within inches of the drain hub

AND
1.3.5 Containment wall where nonene leaked was obscured from operator and STL view
- Operator and STL worked from other side of rail car
  OR
- It was dark outside
  OR
- Containment wall was obscured by rocks and grating
  OR
- Area of containment where nonene slipped by was only 3 inches wide
  OR
- Drainage provided by surrounding rock prevented leak detection

1.4: WHY DID NONENE SLIP OVER A 3 INCH SECTION OF CONTAINMENT?

1.4.1 Drain hub was plugged or partially plugged.
Rocks and dirt from surrounding area were caught in P-Trap
P-Traps cleaned reactively
PSR assumes that plugged drains will be detected when there is a problems

AND
1.4.2 Nonene volume exceeded containment volume of 29 gal
- Designers assumed drain would be free flowing
  OR
- Designers assumed volumes of hydrocarbon drained would be less than 29 gal

AND
1.4.3 Containment wall near drain hub provided path of least resistance.

OBSERVATIONS, INSIGHTS, AND CONCLUSIONS:

Below are listed Observations, Insights, and Conclusions that have been developed throughout the investigation.

MANAGING OWS DRAINS AS A CRITICAL SYSTEM FOR CONTAINMENT

Observation	Operator and STL assumed OWS drain hub was free flowing before they started to drain railcar.
Insight	Although OWS drain hub function is critical to effectively preventing LOPCs, we manage them reactively. We look for clogs only when there is evidence of a problem.
Conclusion	OWS drain hubs are a critical system for keeping hydrocarbon in containment. If we continue to wait for a problem to become obvious before we address it, we are vulnerable to additional LOPCs.

LEAKS CAN OCCUR WITHOUT LEAVING AN OBVIOUS VISUAL CLUE

Observation	50 BBL nonene leaked to the environment while an operator was within 20 feet watching to ensure nonene remained in containment.
Insight	Large LOPCs can occur without leaving obvious visual clues.
Conclusion	Relying of macro visual clues for leak detection may allow for leaks in the future. What assumptions are we making? What are the possible leak mechanisms that could occur leaving no visual clue?

RETAIN MANAGEMENT MAY BE WASTEFUL AND DANGEROUS

Observation	Decision on how to handle retain defaults mostly to draining to OWS unless car is 1/3 full or greater.
Insight	1/3 full = 238 bbl nonene @ $150 bbl = $35,700
Conclusion	Our current method of handling retain may be wasteful.

ESTIMATING VOLUMES VISUALLY IS INACCURATE	
Observation	STL reported an LOPC that was 2050 gal lower than actual volume. The reported volume was based on visual assessment from the top of the railcar. His decision to drain to OWS was based on this assessment.
Insight	Visually estimating product volume in a railcar from the top is highly inaccurate. STL may have elected to recover nonene had he realized the true volume, it's value at approximately $7500 (assuming 150/bbl), and the risk of such a volume to the environment.
Conclusion	Decisions to dump product to the OWS based on visual inspection may be costing us money and posing a risk to the environment.

RECOMMENDATIONS:

Recommendation #1: Draining Philosophy

What cause should be addressed?	50 BBL of Nonene was drained to the containment pan
Why? What would be the benefit?	If we curtail the practice of intentionally draining nonene and other retain products to the containment pan, we will significantly reduce risk of spill and reduce waste.
How? What would be the solution?	Shift away from current philosophy of draining any volume within railcars for both product quality and bad order rail cars to the OWS to a philosophy which manages nonene product quality through testing and bad order rail cars through alternate off loading methods (using accurate testing for volume and pressuring volumes greater than drain capacity back to tank).
How the solution would have prevented the incident	50 bbl of nonene would not have been routed to the OWS. Worst case, we would have pressured most of the material back to tankage, then drained remaining volume to the OWS.
How the solution would prevent similar incidents in the future	The risk of spill from containment and/or from compromised OWS drain will be reduced.
Action Plan:	**Who:** Brian Deaton **What:** Implement a procedure for handling retain that considers the following actions in order of priority: Option 1: Test and leave in car. Option 2: Pressure back to tankage. (List risks) Option 3: Transfer back to tankage by vac truck or other mean. (list risks) Option 4: Drain to OWS using newly developed procedure for ensuring integrity of containment system only in cases

	where other options are not feasible. **When:** 9/3/2012 **Who:** Boyd Wells **What:** Communicate investigation results to RP&S Operators. First draft attached. **When:** 6/7/2012

Recommendation #2: OWS / Containment Design

What cause should be addressed?	• Nonene slipped over a 3 inch section of containment. • Drain hub was plugged or partially plugged. • Containment wall near drain hub provided path of least resistance
Why? What would be the benefit?	We recognize that there are scenarios which require the containment system to work (e.g., drips or sprays from bad order railcar valves). Therefore, if nonene is drained to the containment pan, it must be effectively conveyed to the OWS via the containment pan and trench as well as the p-trap underground.
How? What would be the solution?	1. Improve design of nonene containment pan to ensure that the lowest containment wall location overflows to a highly visible area such as the main drip pan itself. 2. Develop best practice for verifying integrity of the OWS containment system under the nonene loading rack.
How the solution would have prevented the incident	If the containment design was modified, nonene would have been routed to the OWS rather than the surrounding ballast rock. As the volume of the nonene overwhelmed the containment pan volume due to the partial pluggage, the operator would have detected the malfunctioning drain system and stopped the draining out of the railcar.

How the solution would prevent similar incidents in the future	Operator will be able to identify a malfunctioning OWS containment system before nonene or other product leaks to the environment.
Action Plan:	**Who:** Bill Mercer **What:** Modify the design of north and south nonene containment pans around the pipe going to OWS, such that it will reveal overflow and/or a clogged drain in visible area before it overflows to the ballast rock. Issue design package (make sure it references FIM item for completion). When: 2/12/2013 **Who:** Renee Porter **What:** Ensure that containment pan engineering package is installed in the field. **When:** 9/23/2014 **Who:** Brian Deaton **What:** Implement practical solution for verifying integrity of OWS containment system before choosing to drain a railcar. (e.g. complete inspection of containment walls and ensure the drain is free flowing) **When:** 9/3/2012

ATTACHMENT 1: CAUSE TREE

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ATTACHMENT 2: CHARTER DOCUMENT

102411_NoneneSpill_Charter.docx

ATTACHMENT 3: NONENE RAILCAR LOADING PROCEDURE

23RACNO002 *Loading Nonene Tank Cars*

ATTACHMENT 4: TANK CAR INSPECTION FORM

Shell Puget Sound Refinery Tank Car Inspection Form